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WOOD SPECIFIC GRAVITY OF PLANTATION RED PINE LITTLE AFFECTED BY SPACING

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ABSTRACT.—Shows stocking density has little effect on wood specific gravity of red pine.

KEY WORDS: *Pinus resinosa,* wood quality, wood strength.

Red pine (*Pinus resinosa* Ait.) covers more than one million acres in Michigan, Minnesota, and Wisconsin. A large percentage of this acreage is plantations. Early thinnings of these plantations will yield pulpwood, posts, and some poles. And, specific gravity of this wood is an important quality factor affecting fiber yield, working and finishing qualities, and strength. The purpose of this note is to quantify the effect of spacing on wood specific gravity for red pine grown on a good site.

METHODS

The study area, located in Burnett County in northwestern Wisconsin, was planted in the spring of 1958 with 2-1 red pine nursery stock on soil described as Plainfield sand.[1] Seedlings were planted at spacings of 5- by 5-feet, 7- by 7-feet, 9- by 9-feet, and 11- by 11-feet. Mean height of dominant and codominant trees is 32 feet, and mean stand diameters for the four spacings are 4.3, 5.5, 6.5, and 7.3 inches, respectively. Total tree age is 23 years. Site index is estimated at 70 feet.

Six trees from each of the four spacings were sampled. Only dominant and codominant trees were selected because they represent the effect of spacing on specific gravity without the additional effect of suppression on specific gravity that would be present in intermediate and suppressed trees. A disc was cut at 4.5 feet and between each whorl from the base of the tree up to and including the current year's growth. The bark was removed and the green discs soaked in water for 48 hours, weighed to the nearest 0.5 gram, and immersed and weighed again to determine volume by the displacement method. Discs were ovendried (70C) for 48 hours and weighed a third time. Specific gravity was determined by:

$$\text{Specific gravity} = \frac{\text{ovendry weight}}{\text{weight (wet, air)} - \text{weight (wet, immersed)}}$$

RESULTS

Specific gravity at 4.5 feet increased as the number of trees per acre increased (table 1). However, the

[1] *Study maintained in cooperation with Burnett County and Wisconsin Department of Natural Resources.*

Table 1.—*Specific gravity of dominant trees in a 20-year-old plantation*[1]

Height (feet)	Spacing (feet)			
	5	7	9	11
2	.3511	.3379	.3337	.3388
4.5	.3495	.3337	.3325	.3315
6	.3494	.3308	.3297	.3284
8	.3447	.3274	.3263	.3276
12	.3430	.3276	.3257	.3231
14	.3412	.3271	.3272	.3214

[1]2-1 trees planted, total tree age is 23 years.

only difference of any magnitude occurred between the trees in the 5- by 5-foot spacing and those in the other three spacings. The same relation was exhibited at other heights above ground (table 1).

In a similar study, Wambach[2] (1967) investigated the relation between specific gravity and spacing in red pine plantations over a wide range of sites. He determined specific gravity from increment cores taken at 4.5 feet and produced an equation to predict specific gravity as a function of site index and number of trees per acre. Our estimate of specific gravity for 889 (7- by 7-foot), 538 (9- by 9-foot), and 360 (11- by 11-foot) trees per acre are close to his estimates (+1.3 to 1.8 percent). However, our estimate of specific gravity for 1,742 (5-by 5-foot) trees per acre deviates from his by +4.6 percent and equals his estimate of specific gravity for 1,600 trees per acre at site index 57.

We hypothesize that on good sites with narrow spacing, competition occurs early and diameter growth parallels that of plantations with fewer trees per acre but on poorer sites. If this is true, the mean stand diameter of 1,600 trees per acre, site index 57, should be approximately the same as our mean stand diameter. Because there is a 1- or 2-year difference in reaching 4.5 feet in height, the number of growth rings at 4.5 feet for 25-year-old trees, site index 57, should not differ by more than one from 23-year-old trees, site index 70. From Wambach,[2] the mean stand diameter for 25-year-old trees, site index 57, with 1,600 trees per acre is 4.3 inches, the same as our plantation with 1,742 trees per acre.

The combination of age, site index, and 5- by 5-foot spacing of our plantation is on the periphery of the 85 plantations in Wambach's data set. And, perhaps, his data set could not capture this trend. Although our estimate of specific gravity for very narrow spacing and good site differs from Wambach's, for practical purposes it is probably unimportant because this combination of site index and spacing represents a small percentage of existing plantations.

DISCUSSION

The spatial distribution of trees has a large effect on main stem diameter growth[2] and size of branches[3] but has little effect on the specific gravity of wood. Spacing of trees from 7 to 11 feet did not change specific gravity more than 2 percent and the closest spacing of 5 feet increased specific gravity about 5 percent. The use of narrow spacing in red pine plantations is not a practical method to increase specific gravity, and little concern should be given to small decreases in specific gravity of red pine at very wide spacings.

[2]*Wambach, Robert F. 1967. A silvicultural and economic appraisal of initial spacing in red pine. 282 p. Ph.D. Thesis, University of Minnesota.*

[3]*Laidly, Paul R., and Robert G. Barse. 1979. Spacing affects knot surface in red pine plantations. U.S. Department of Agriculture Forest Service, Research Note NC-246, 3 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.*

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